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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/802,087
Filing Date: March 16, 2004
Appellant(s): CHANG ET AL.

Joseph Mencher
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed September 13, 2010 appealing from the Office action mailed April 7, 2010.

(1) Real Party in Interest

A statement identifying by name the real party of interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

2-27

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner: The 35 U.S.C. 102(b) rejections of claims 15-19 as being anticipated by WO 99/49504.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

U.S. Patent Application Publication 2006/0023185 by Hazelton et al., published Feb. 2, 2006

U.S. Patent Application Publication 2005/0161644 by Zhang et al., published Jul. 28, 2005

7,056,646	Amblard et al.	6-2006
7,125,652	Lyons et al.	10-2006
5,443,801	Langford	10-1995

U.S. Patent Application Publication 2004/0125351 by Krautschik, published Jul. 1, 2004

U.S. Patent Application Publication 2005/0164502 by Deng et al., published Jul. 28, 2005

Machine Translation of WO 99/49504 by Fukami, published Sep. 30, 1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

Claims 2-6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in view of Zhang et al (US 2005/0161644) in further view of Amblard et al (US 7,056,646).

For claims 6 and 8, Hazelton et al teach a method for cleaning an optical element (abstract, L. 12-13) related to an immersion lithography system comprising the steps of performing an immersion lithography process (i.e. exposing wafer with light through the optical element in the presence of a first fluid, paragraph [0009]); and then having the optical element brought into contact with cleaning liquid (read as second fluid, paragraph [0013]). While Hazelton et al do not explicitly teach the positioning step, such step must be made in order to expose the wafer, which means that the step is implicitly in. (Also see abstract, P.2, L.19-20; P.3, L.6-9; and Fig.10 of the WO 2004/093130 (PCT application PCT/US2004/010309); Summary of the Invention and Fig.1 of 60/482,913).

Hazelton et al remain silent about providing a first fluid containing surfactant.

However, Zhang et al teach a step of providing an immersion fluid comprising a surfactant to minimize formation of micro-bubble (paragraph [0012]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Hazelton et al by providing a first fluid containing surfactant as mentioned in Zhang et al to minimize formation of micro-bubble (Zhang et al, paragraph [0012]).

Both Hazelton et al and Zhang et al do not teach a step of providing a second fluid having a higher surfactant concentration than the first fluid.

Amblard et al teach a step of providing a base developer to clean glass (col.3, L.5) comprising ethanol (col.3, L.12), ammonium hydroxide (col.3, L.18-19) and surfactants (col.4, L.27).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of combined teaching of Hazelton et al and Zhang et al by providing a second fluid having surfactant as mentioned in Amblard et al to enhance manufacture efficiency by cleaning the optical element while developing the substrate. Regarding a second fluid having a higher surfactant concentration than the first fluid, it is noted that appellant has not shown that having a higher surfactant concentration in the second fluid is critical. In the developed method of Hazelton et al in view of Zhang et al in view of Amblard et al, the concentration of the surfactant in the second fluid is considered to be a result effective variable because it affects the efficiency for cleaning the optical element (for example, concentration of soap (a kind of surfactant) presented in a cleaning solution will affect the efficiency for cleaning), and one skilled in the art would modify different variables to achieve optimum result, consult, In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

For claim 2, note that the presence of photoresist is reasonably expected within the combined teaching of Hazelton et al, Zhang et al and Amblard et al since the wafer undergoes a light exposing operation, which projects image on the wafer.

For claim 3, note that the first fluid forms an immersion lens when performing a light exposing operation.

For claim 4, note that the surfactant inherently reduce surface tension of the

optical element with the first fluid.

For claim 5, note that the step of surfactant changing a surface property of the wafer to make it more hydrophilic is within the combined teaching of Hazelton et al; Zhang et al and Amblard et al since the surfactant reduce surface tension of a surface of the wafer and first fluid.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in view of Zhang et al (US 2005/0161644) and Amblard et al (US 7,056,646) in further view of Krautschik (US 2004/0125351).

Hazelton et al, Zhang et al and Amblard et al teach a method for cleaning lens used in an immersion lithography system cited above.

Hazelton et al, Zhang et al and Amblard et al do not teach a step of providing the first fluid before starting the light exposing operation. However, Krautschik teaches a step of immersing a gap between a lens element and a substrate with an immersion liquid, before starting projecting image of reticle onto the substrate (read as providing the first fluid before starting the light exposing operation, Fig.5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of combined teaching of Hazelton et al, Zhang et al and Amblard et al by having a step of providing the first fluid before starting the light exposing operation as mentioned in Krautschik such that projected light can passes through the immersion liquid to perform immersion lithography, which enhance resolution.

Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in view of Lyons et al (US 7,125,652) in further view of Amblard et al (US 7,056,646).

Hazelton et al teach a method for cleaning an optical element (abstract, L. 12-13) related to an immersion lithography system comprising the steps of performing an immersion lithography process (i.e. exposing wafer with light through the optical element in the presence of a first fluid, paragraph [0009]); and then having the optical element brought into contact with cleaning liquid (read as second fluid, paragraph [0013]). While Hazelton et al do not explicitly teach the positioning step, such step must be made in order to expose the wafer, which means that the step is implicitly in. (Also see abstract, P.2, L.19-20; P.3, L.6-9; and Fig.10 of the WO 2004/093130 (PCT application PCT/US2004/010309); Summary of the Invention and Fig.1 of 60/482,913).

Hazelton et al remain silent about the composition of the first fluid. However, Lyons et al disclose that it is well known to use de-ionized water as an immersion lithography medium when performing a light exposing operation (col.1, L.47-48).

It would have been obvious to one of ordinary skill in the art at the time the invention as made to modify the method of Hazelton et al by using de-ionized water as an immersion lithography mediums as mentioned in Lyons et al since de-ionized water is cost effective and easy handling.

Both Hazelton et al and Lyons et al do not teach the second fluid comprising a surfactant-spiked water immersion fluid.

However, Amblard et al teach a step of providing a base developer to clean glass (col.3, L.5) comprising ethanol (col.3, L.12), ammonium hydroxide (col.3, L.18-19) and an ionic or non-ionic surfactants (col.4, L.27-28).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of combined teaching of Hazelton et al and Lyons et al by providing a second fluid having surfactant as mentioned in Amblard et al to enhance manufacture efficiency by cleaning the optical element while developing the substrate.

For claim 10, note that the presence of photoresist is reasonably expected within the teaching of combined teaching of Hazelton et al, Lyons et al and Amblard et al since the wafer undergoes a light exposing operation, which projects image on the wafer.

For claim 12, the combined teaching of Hazelton et al, Lyons et al and Amblard et al teach using ionic surfactant (Amblard, col.4, L.27-28).

For claim 13, the combined teaching of Hazelton et al, Lyons et al and Amblard et al teach using non-ionic surfactant (Amblard, col.4, L.27-28).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in view of Lyons et al (US 7,125,652) and Amblard et al (US 7,056,646), and as evidenced by Zhang et al (US 2005/0161644).

For claim 14, Hazelton et al, Lyons et al and Amblard et al teach a method for cleaning an optical element. Note that the first and second fluids inherently minimize micro-bubble. Zhang et al evidence that providing at least one carrier medium such as de-ionized water (Zhang et al, paragraph [0013]) without the addition of at least one

additive will provide a benefit of minimizing the formation of micro-bubbles (Zhang et al, paragraph [0012]).

Claims 15-19 rejected under 35 U.S.C. 103(a) as being unpatentable over Deng et al (US 2005/0164502) in view of Hazelton et al (US 2006/0023185).

With regard to claim 15, applicants' means for positioning a wafer, in accordance with 35 U.S.C. 112 sixth paragraph, is presumed to refer to a wafer stage (Fig.4, #402). The use of wafer stage is discussed in paragraphs 25 of the specification. Applicants' means for providing the first fluid containing no surfactant, in accordance with 35 U.S.C. 112 sixth paragraph, is presumed to refer to a primary supply reservoir (Fig.4, #412), as discussed in paragraph 25 of the specification. Applicants' means for providing a surfactant to the first fluid to form a second fluid to reduce an adherence of floating defects to the wafer or the objective lens, in accordance with 35 U.S.C. 112 sixth paragraph, is presumed to refer to a secondary supply reservoir (Fig. 4, not shown), as discussed in paragraph 26 of the specification. With regard to claim 16, applicants' means for collecting the first fluid, in accordance with 35 U.S.C. 112 sixth paragraph, is presumed to refer to a primary recovery reservoir (Fig.4, #414). The use of primary recovery reservoir is discussed in paragraphs 25 of the specification. With regard to claim 19, applicants' means for collecting the second fluid, in accordance with 35 U.S.C. 112 sixth paragraph is presumed to refer to a secondary recovery reservoir (Fig.4, not shown). The use of secondary recovery reservoir is discussed in paragraph 26 of the specification.

The recitation "means for performing a light exposing operation on the wafer

using an objective lens immersed in the first fluid" (claim 15, L. 4-5) is not interpreted under 35 USC 112, sixth paragraph, because it is modified by sufficient structure, material, or acts for achieving the specified function. MPEP 2181.

For claims 15 and 19, Deng et al teach an immersion lithography system comprising a wafer stage (Fig.l, #240, paragraph [0011]); a liquid supply (read as a supply reservoir, Fig.2, #220, paragraph [0011]); a liquid recovery (read as a recovery reservoir, Fig.2, #230, paragraph [0011]); and an imaging lens system (read as means for performing a light exposing operation on the wafer using an objective lens immersed in the first fluid, Fig.2, #210, paragraph [0011]).

Deng et al remain silent about a means for providing a surfactant to the first fluid to form a second fluid to reduce an adherence of floating defects to the wafer or the objective lens; and means for collecting the second fluid.

Hazelton et al teach a cleaning liquid supplying means (Fig.10, unlabeled, the pipe on top of a valve #25; Fig.10 of WO 2004/093130, #23; and drain of Fig.1 of 60/482,913), which is fully capable of providing a surfactant to the immersion liquid to reduce an adherence of floating defects to the wafer or the optical element; and a recovery nozzle (Fig. 10, #23; Fig.10 of WO 2004/093130, #23; and drain of Fig.1 of 60/482,913). (Also see abstract and Fig.10 of the WO 2004/093130 (PCT application PCT/US2004/010309); and Fig.1 of 60/482,913).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Deng et al by adding a cleaning liquid supplying means; and a recovery nozzle as motivated by Hazelton et al to enhance

cleaning procedure, such that an optical element can be easily maintained and its useful lifetime can be improved (paragraph [0008] and paragraph [0014] of US 2006/00231985; P.2, L.10 and P.3, L.10-11 of WO 2004/093130 (PCT application PCT/US2004/010309; and P.2, L.6-7 and L9-10 of 60/482,913).

Deng et al and Hazelton et al remain silent about the cleaning liquid supplying means comprising a supply reservoir; and a recovery nozzle comprising a recovery reservoir.

However, WO 99/49504 teaches an immersion lithography system providing a liquid supply (read as supply reservoir, Fig.2, #5); and a liquid recovery (read as recovery reservoir, Fig.2, #6) for supplying and recovering liquid between a projection optical system (Fig.4, #PL, abstract) and a wafer (Fig.4, #W, abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of combined teaching of Deng et al and Hazelton et al by adding a supply reservoir (read as means for providing the first fluid containing no surfactant) to the means for supplying a cleaning liquid; and a recovery reservoir (read as means for collecting the second fluid as in claim 19) to the recovery nozzle as motivated by WO 99/49504 to ensure liquid is provided if needed and to collect used liquid for reuse or later disposal.

For claim 16, note that Deng et al teach a liquid recovery (read as a recovery reservoir, Fig.2, #230, paragraph [0011]).

For claims 17 and 18, since all the structures are found in the prior art, it is fully capable of performing the functions as recited in claims 17-18.

Claims 20-21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in further view of Amblard et al (US 7,056,646).

Hazelton et al teach a method for cleaning an optical element (abstract, L. 12-13) related to an immersion lithography system comprising the steps of performing an immersion lithography process (i.e. exposing wafer with light through the optical element in the presence of a first fluid, paragraph [0009]); and then having the optical element brought into contact with cleaning liquid (read as second fluid, paragraph [0013]). While Hazelton et al do not explicitly teach the positioning step, such step must be made in order to expose the wafer, which means that the step is implicitly in. (Also see abstract, P.2, L.19-20; P.3, L.6-9; and Fig.10 of the WO 2004/093130 (PCT application PCT/US2004/010309); Summary of the Invention and Fig.1 of 60/482,913).

Hazelton et al do not teach the second fluid comprising a surfactant and NH_4OH.

However, Amblard et al teach a step of providing a base developer to clean glass (col.3, L.5) comprising water (col.3, L.11), ethanol (col.3, L.12), ammonium hydroxide (col.3, L.18-19) and an ionic or non-ionic surfactants (col.4, L.27-28).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of combined teaching of Hazelton et al and Lyons et al by providing a second fluid having surfactant as mentioned in Amblard et al to enhance manufacture efficiency by cleaning the optical element while developing the substrate.

For claim 21, note that the presence of photoresist is reasonably expected within

the teaching of combined teaching of Hazelton et al and Amblard et al since the wafer undergoes a light exposing operation, which projects image on the wafer.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in further view of Amblard et al (US 7,056,646) in further view of Lyons et al (US 7,125,652).

Hazelton et al and Amblard et al teach a method for cleaning an optical element cited above.

Hazelton et al and Amblard et al do not teach the first fluid is a de-ionized water.

However, Lyons et al disclose it is well known to use de-ionized water as an immersion lithography medium when performing a light exposing operation (col.1, L.47-48).

It would have been obvious to one of ordinary skill in the art at the time the invention as made to modify the method of combined teaching of Hazelton et al and Amblard et al by using de-ionized water as an immersion lithography mediums mentioned in Lyons et al since de-ionized water is cost efficiency and easy handling.

Claims 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in further view of Amblard et al (US 7,056,646) in further view of Langford (US 5,443,801).

Hazelton et al and Amblard et al teach a method for cleaning an immersion lithography system cited above.

For claims 24-25 and 27, both Hazelton et al and Amblard et al do not teach a step of providing the second fluid comprising peroxide (H202).

However, Langford discloses a step of using a solution having hydrogen peroxide to disinfect an optical element (col.2, L.28-30).

Since it is well known that one particular problem of contaminants which can adversely affect the quality of the exposure pattern incident on the wafer is that growth of biological contaminants (e.g. bacteria, algae, etc) on parts that come in contact with an immersion fluid, one skill in the art would have been found obvious to add hydrogen peroxide into the second fluid of combined teaching of Hazelton et al and Amblard et al to control the presence of biological contaminants.

For claim 26, both Hazelton et al and Amblard et al do not teach a step of providing the second fluid comprising ozone (03).

However, Langford teaches a step of using ozone bath to sterilize and clean an optical element (col.5, L.54-63).

Since it is well known that one particular problem of contaminants which can adversely affect the quality of the exposure pattern incident on the wafer is that growth of biological contaminants (e.g. bacteria, algae, etc) on parts that come in contact with an immersion fluid, one skill in the art would have been found obvious to add ozone (03) into the second fluid of combined teaching of Hazelton et al and Amblard et al to control the presence of biological contaminants.

(10) Response to Argument

Claims 2-6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in view of Zhang et al (US 2005/0161644) in further view of Amblard et al (US 7,056,646).

Appellant argues that it would not be obvious to modify the method of Hazelton in view of Zhang by using Amblard's immersion liquid as a cleaning liquid because Amblard teaches away from that concept because Amblard's immersion liquid advantageously contains developer such that a separate developer solution does not need to be employed after the immersion liquid is removed. However, this argument is not persuasive because the examiner is not modifying the combination of Hazelton in view of Zhang with the teachings of Amblard in order to change the process of supplying an immersion liquid and subsequently supplying a cleaning fluid; the examiner is modifying the combination of Hazelton in view of Zhang with the teachings of Amblard simply to take advantage of the cleaning solution taught by Amblard. Further, in the combination of Hazelton in view of Zhang in view of Amblard, immersion fluid is supplied and Amblard's immersion fluid is then supplied as a cleaning solution. The combination of Hazelton in view of Zhang in view of Amblard does not teach supplying a developer solution after Amblard's immersion fluid is supplied, and therefore, the combination of Hazelton in view of Zhang in view of Amblard is not considered to be at odds with Amblard's teaching that developer solution does not need to be supplied after Amblard's immersion liquid is removed.

Claims 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in view of Lyons et al (US 7,125,652) in further view of Amblard et al (US 7,056,646).

Appellant argues that it would not be obvious to modify the method of Hazelton in view of Lyons by using Amblard's immersion liquid as a cleaning liquid because Amblard teaches away from that concept because Amblard's immersion liquid advantageously contains developer such that a separate developer solution does not need to be employed after the immersion liquid is removed. However, this argument is not persuasive because the examiner is not modifying the combination of Hazelton in view of Lyons with the teachings of Amblard in order to change the process of supplying an immersion liquid and subsequently supplying a cleaning fluid; the examiner is modifying the combination of Hazelton in view of Lyons with the teachings of Amblard simply to take advantage of the cleaning solution taught by Amblard. Further, in the combination of Hazelton in view of Lyons in view of Amblard, immersion fluid is supplied and Amblard's immersion fluid is then supplied as a cleaning solution. The combination of Hazelton in view of Lyons in view of Amblard does not teach supplying a developer solution after Amblard's immersion fluid is supplied, and therefore, the combination of Hazelton in view of Lyons in view of Amblard is not considered to be at odds with Amblard's teaching that developer solution does not need to be supplied after Amblard's immersion liquid is removed.

Claims 15-19 rejected under 35 U.S.C. 103(a) as being unpatentable over Deng et al (US 2005/0164502) in view of Hazelton et al (US 2006/0023185).

Appellant argues against modifying the structure of Deng with the teachings of Hazelton by arguing that since Hazelton does not teach that Hazelton's cleaning liquid supplying means performs the function of providing a surfactant to a first fluid such that the surfactant and first fluid are mixed, the structure of Deng cannot be modified with the cleaning liquid supplying means of Hazelton to arrive at the claimed structure. However, although Hazelton does not teach using his cleaning liquid supplying means to provided a surfactant to a first fluid such that the surfactant and first fluid are mixed, when the apparatus of Deng is modified with the teachings of Hazelton as discussed in the rejection of claim 15, the cleaning liquid supplying means in the combination of Deng in view of Hazelton is structurally capable of supplying surfactant to immersion liquid such that the surfactant and immersion liquid are mixed in order to reduce an adherence of floating defects to the wafer or the objective lens. A recitation of the intended use of a claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art.

Claims 20-21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hazelton et al (US 2006/0023185) in further view of Amblard et al (US 7,056,646).

Appellant argues that it would not be obvious to modify the method of Hazelton by using Amblard's immersion liquid as a cleaning liquid because Amblard teaches

away from that concept because Amblard teaches that Amblard's immersion liquid advantageously contains developer such that a separate developer solution does not need to be employed after the immersion liquid is removed. However, this argument is not persuasive because the examiner is not modifying the method of Hazelton with the teachings of Amblard in order to change the process of supplying an immersion liquid and subsequently supplying a cleaning fluid; the examiner is modifying the method of Hazelton with the teachings of Amblard simply to take advantage of the cleaning solution taught by Amblard. Further, in the combination of Hazelton in view of Amblard, immersion fluid is supplied and Amblard's immersion fluid is then supplied as a cleaning solution. The combination of Hazelton in view of Amblard does not teach supplying a developer solution after Amblard's immersion fluid is supplied, and therefore, the combination of Hazelton in view of Amblard is not considered to be at odds with Amblard's teaching that developer solution does not need to be supplied after Amblard's immersion liquid is removed.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/RLC/

Ryan L. Coleman

Patent Examiner, Art Unit 1714

November 15, 2010

Conferees:

/Michael Kornakov/

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